Advanced High Strength Steels for Automotive Lightweighting

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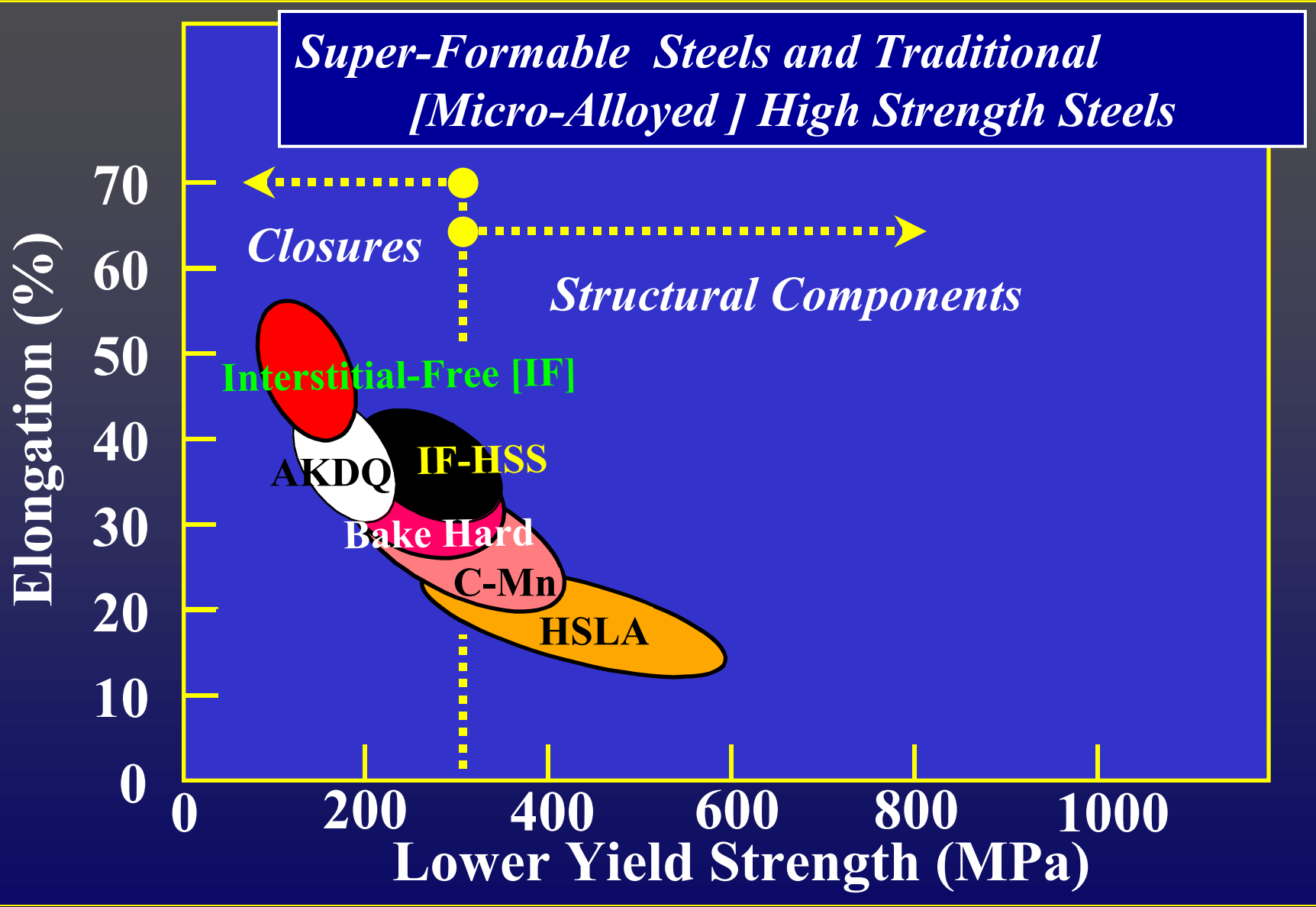
National Steel Corporation

Existing and Emerging Steels for Automotive Lightweighting



The Advent of Advanced High Strength Steels in Auto

Driving Forces for the use of AHSS are the same in all Regions of the World

- ***Mass Reduction [Fuel Economy, Eco-Directives]***
- ***Affordability***
- ***Safety Considerations***

AISI Survey of Global Auto. & Steel Companies—Use of AHSS*

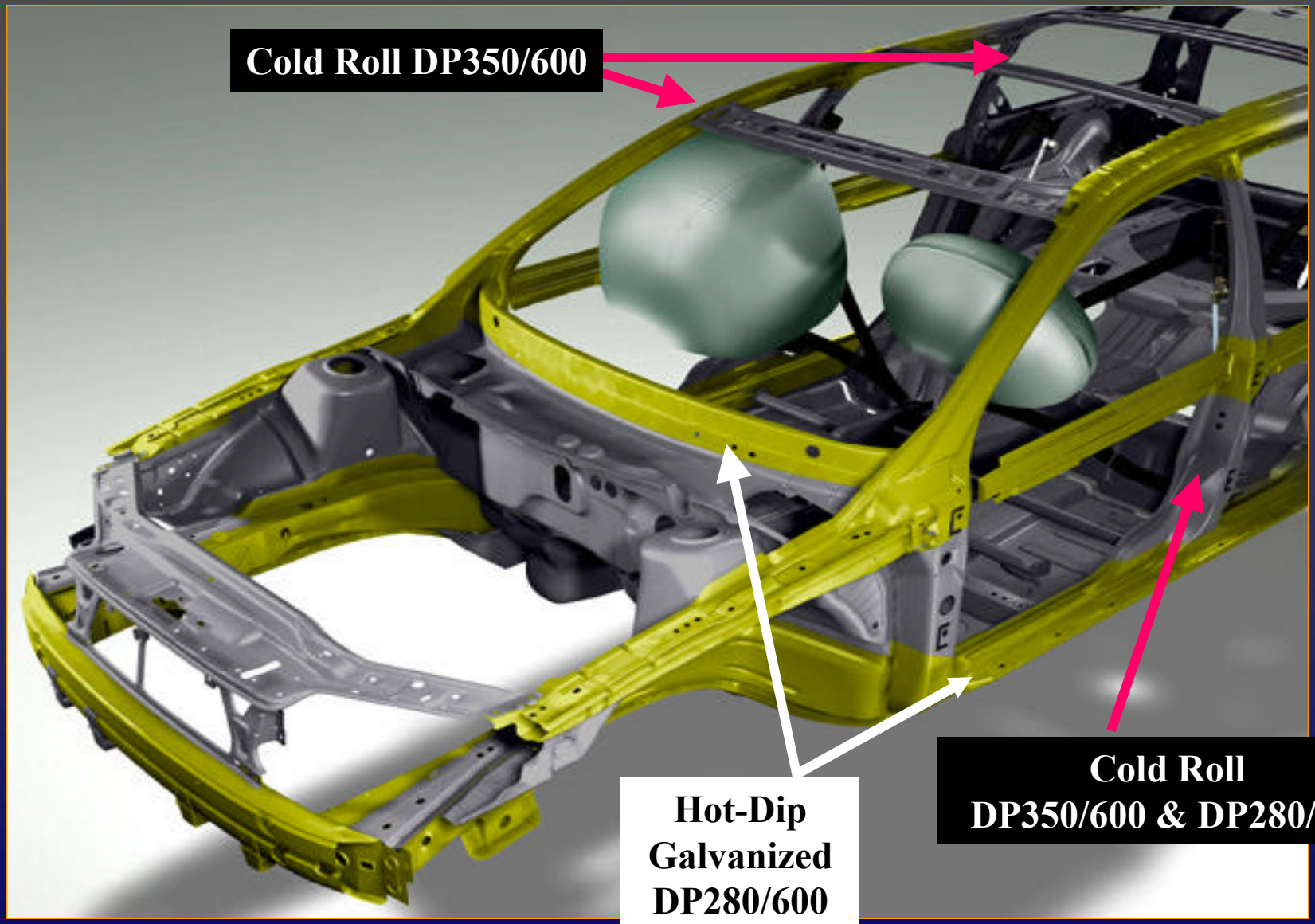
	N. America	Europe	Japan
Current Models	LIMITED Hang on Parts No BIW No Suspension	**LIMITED** Hang on Parts Minor BIW No Suspension	**LIMITED** Hang on Parts Minor BIW No Suspension
Near Term Models < 2 yrs.	**LIMITED** Hang on Parts No BIW No Suspension	EXPANDED Hang on Parts More BIW Structurals (DP/ TRIP) No Suspension	**EXPANDED** Hang on Parts More BIW Structural Parts (DP/ TRIP) Suspension Parts
Next Generation Models (~ 4 yrs.)	**LIMITED** Hang on Parts No BIW No Suspension	**EXPANSION** Hang on Parts More BIW Structurals (DP/ TRIP) Suspension Parts	**EXPANSION** Hang on Parts More BIW Structural Parts (DP/ TRIP) Suspension Parts

*** 1999/2000**

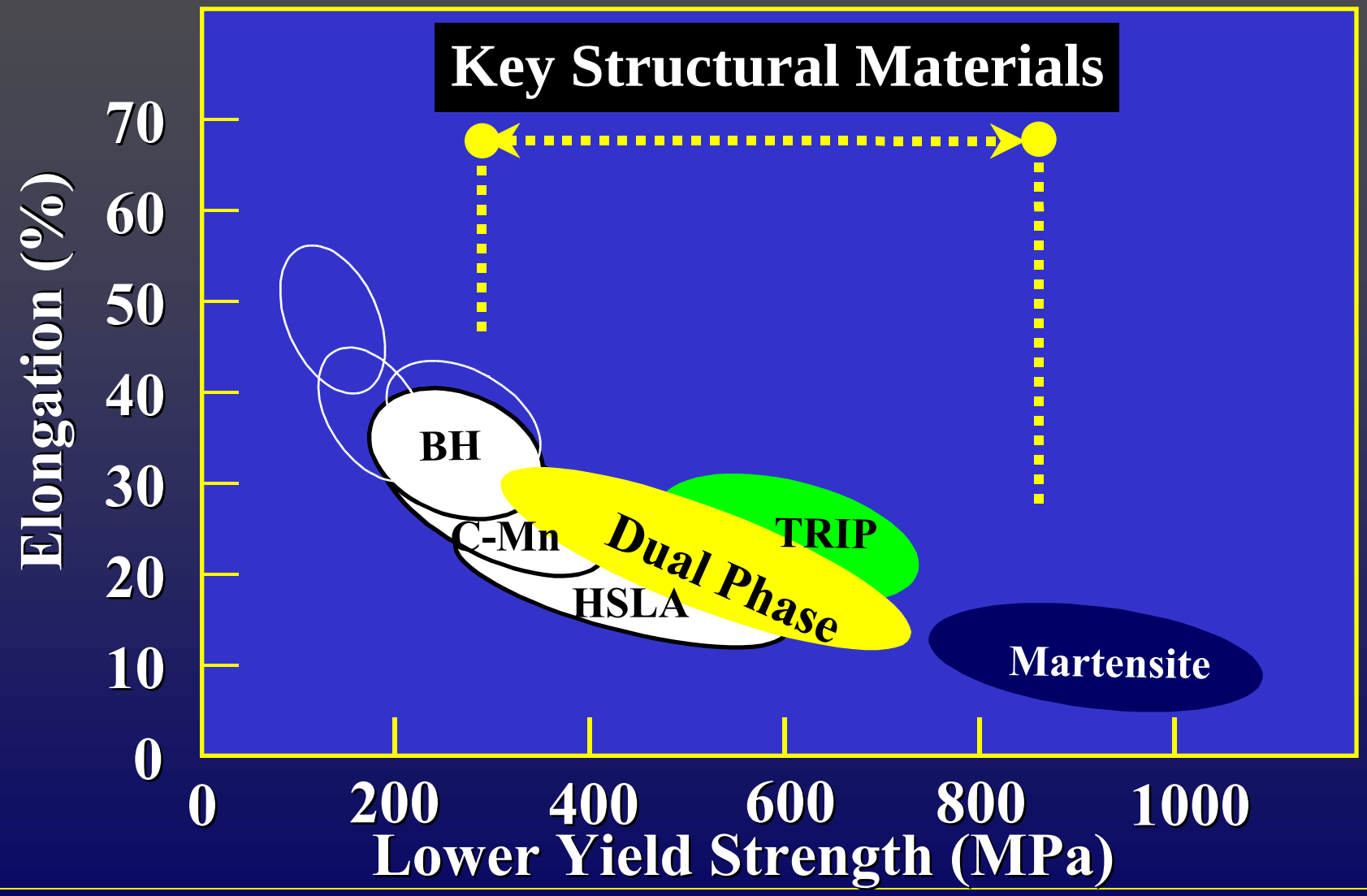
The Advent of Advanced High Strength Steels in Auto

- **Driving Forces for use of AHSS are the same in all Regions of the World**

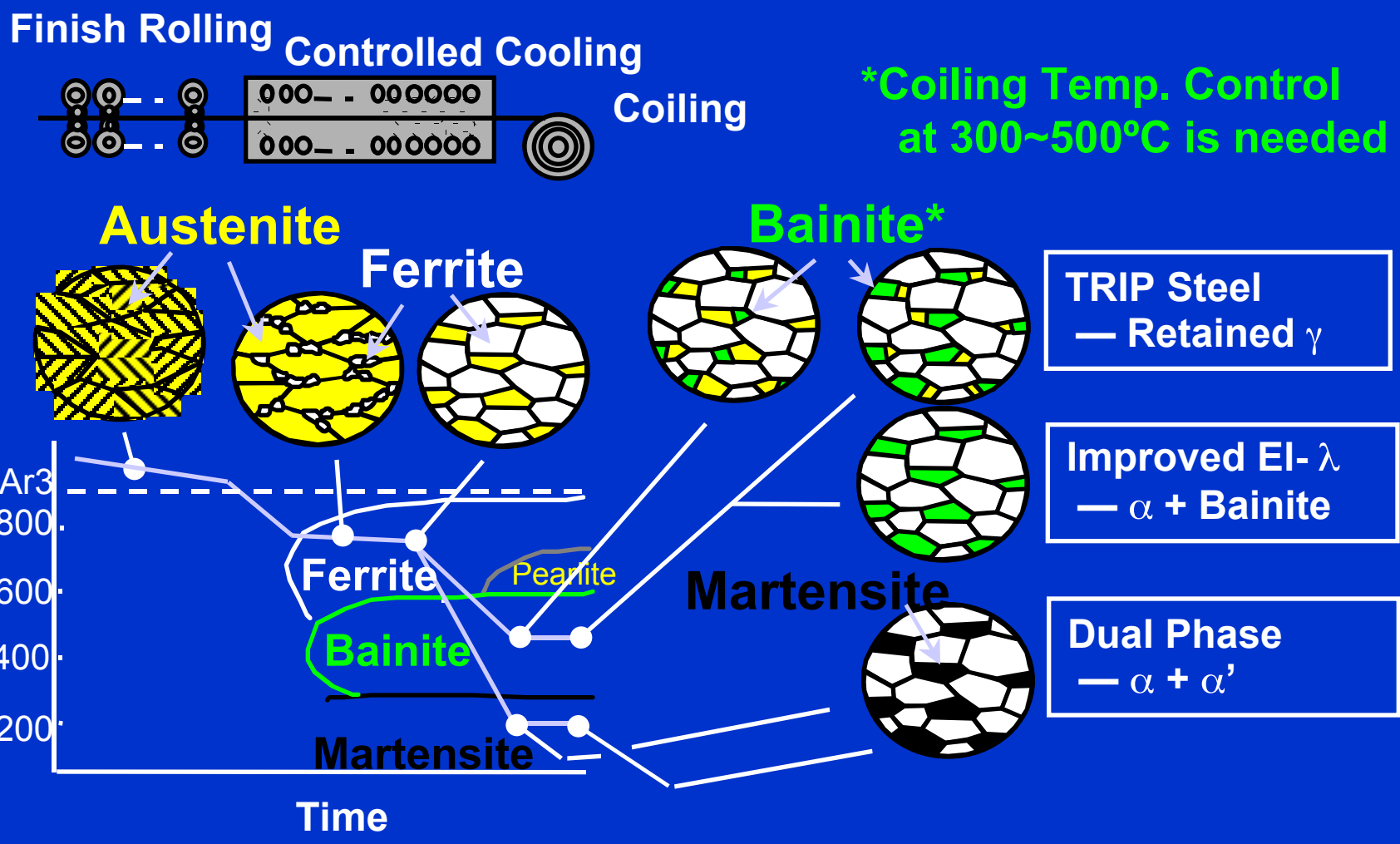
- **New Consideration — Globalization of the OEMs**
  - **— *Mergers and Worldwide Specifications are Fueling* Intense *Local Interest in AHSS***
  - **— *Drivers for* Immediate *application of AHSS are* affordable safety *and* affordable lightweighting**


Cold Roll DP350/600
Hot-Dip Galvanized DP280/600
Cold Roll DP350/600 & DP280/600

Existing and Emerging Steels for Automotive Lightweighting

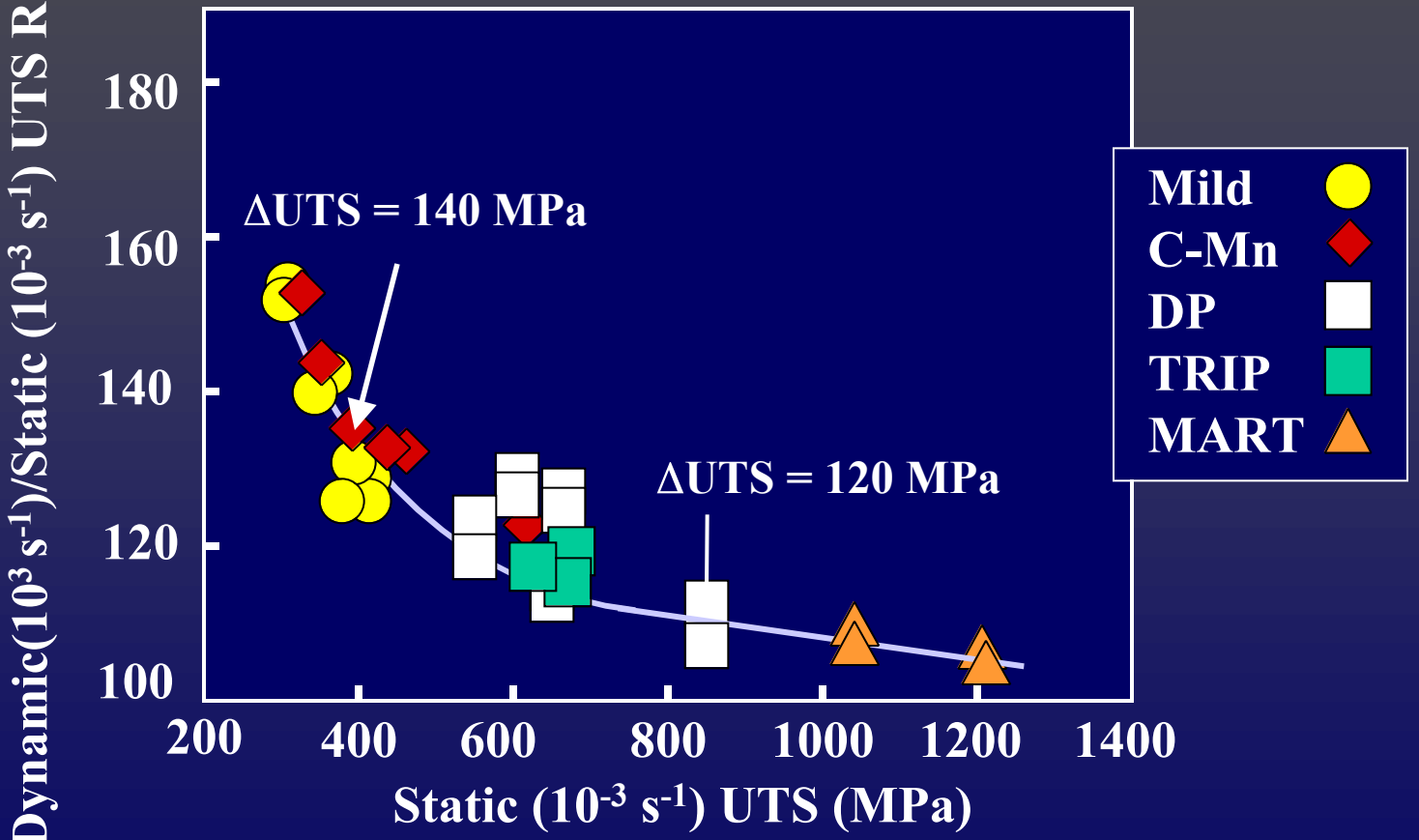


Transformation Strengthened HSS



Steel Strain Rate Hardening

Dynamic Ratio decreases with increasing strength but Strain Rate Sensitivity (Δ UTS) remains constant, independent of microstructure



Steels for Automotive Structural Applications

Product	Advantages	Disadvantages	Best Applications
Low C AKDQ	• Lowest cost • Excellent formability, DQ and DDQ grades	Low strength for applications needing downgauging	Structural parts constrained by stiffness from downgauging
HSLA	• Familiarity • Good weldability for HSS	Lowest formability	Rails, cross members, brackets, braces, reinforcements
HS IF and C–Mn	• More uniform, less springback • Good fatigue	Difficult to weld highest strength grades	• Front & rear rails • Pillars • Multi-joining members
Dual Phase	High strength with excellent formability	High alloy content = poor spot weldability	Crash-sensitive parts - front and rear rails
TRIP	High strength with small strain	High alloy content = poor spot weldability	Structural components limited by buckling - cross members

ULSAB-AVC — Materials Portfolio and Simultaneous Engineering

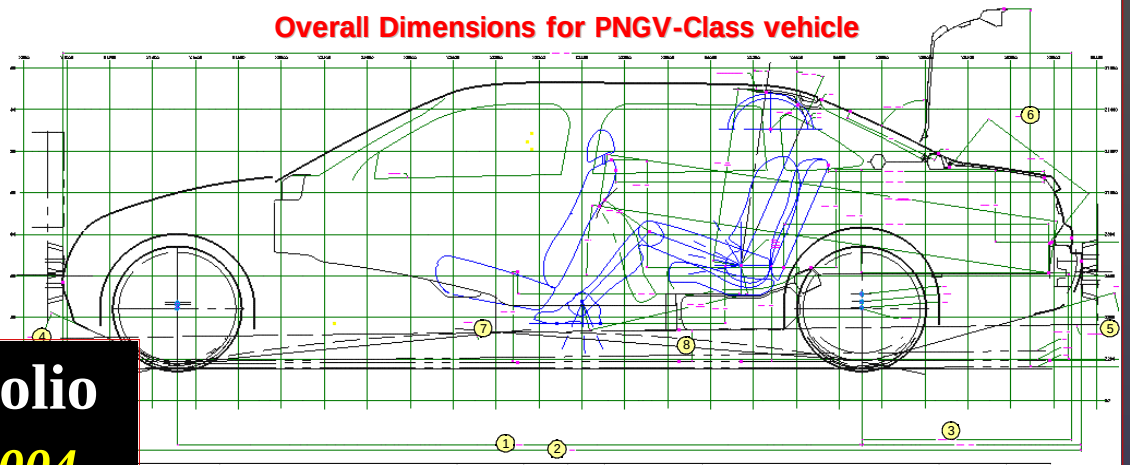
Preliminary Steel Portfolio

- *Commercially Feasible by 2004*
- *High Strain Rate Data Available*

Simultaneous Engineering

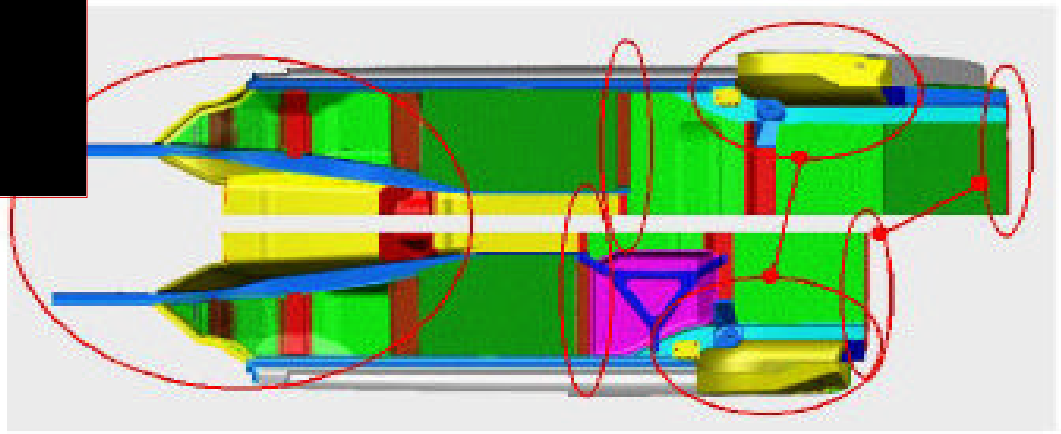
- *Component Feasibility*
- *Lightweighting Potential*
- *Cost reduction Potential*

Overall Dimensions for PNGV-Class vehicle



L 101	Wheelbase	3190	mm	5	H 107	Angle of Departure	15.8	°
L 103	Vehicle Length	4751	mm	6	H 110	Vehicle Height Tailgate Open	1724	mm
L 105	Rear Overhang	1026	mm	7	H 147	Ramp Angle	10.4	°
H 106	Angle of Approach	25.3	°	8	H 156	Ground Clearance	144	mm

Porsche Engineering Services, Inc. Preliminary Information - Work-in-Progress



Concluding Comments

- **We are witnessing the dawn in a new era of Materials for automotive applications……the AHSS era**
- **Advanced High Strength Steels will be widely used globally because they uniquely satisfy all Auto Driving Forces:**
  - ***Mass Reduction [Fuel Economy, Eco-Directives]***
  - ***Affordability***
  - ***Increased Safety Requirements***
- **Globalization of the Automotive OEMs is accelerating the application of AHSS**
- **The ULSAB-AVC [UltraLight Steel Auto Body-Advanced Vehicle Concepts Consortium is an Important Demonstration of Optimized use of AHSS**